

1/17

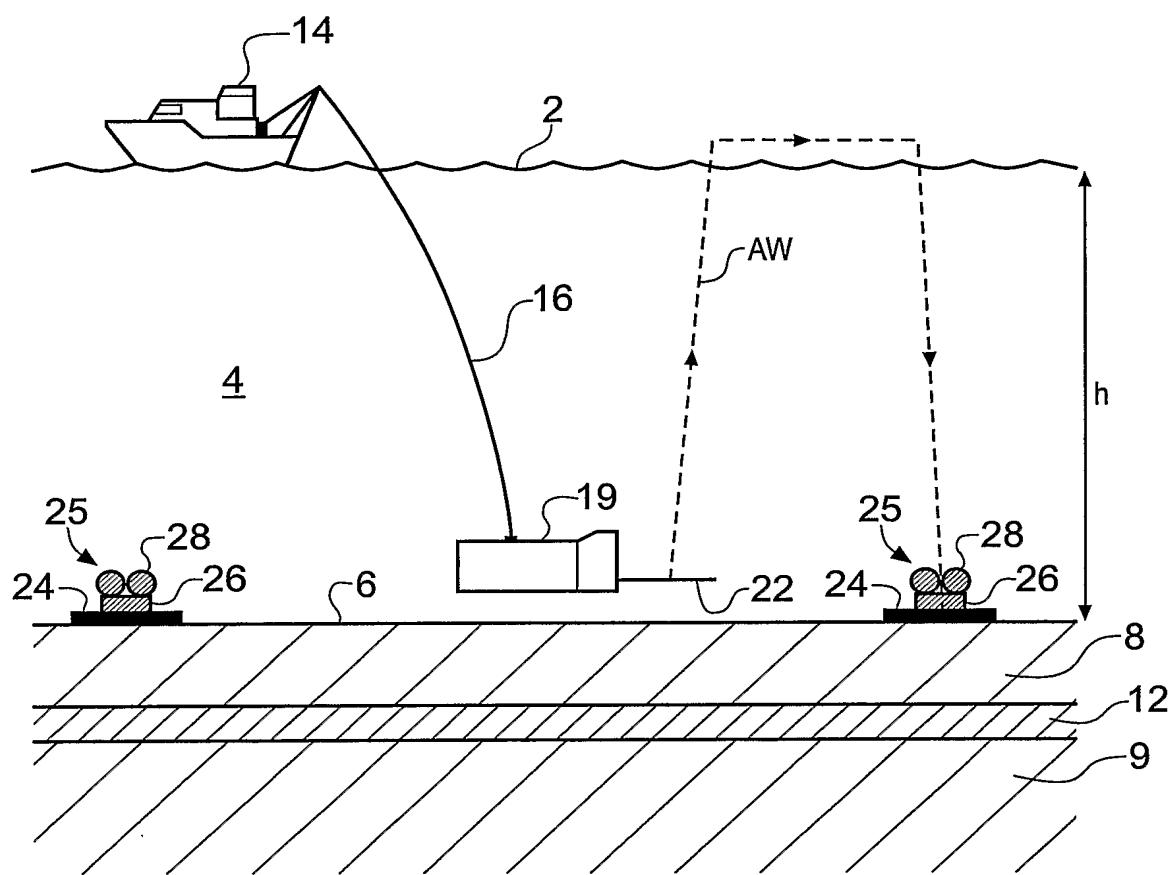


Fig. 1
PRIOR ART

2/17

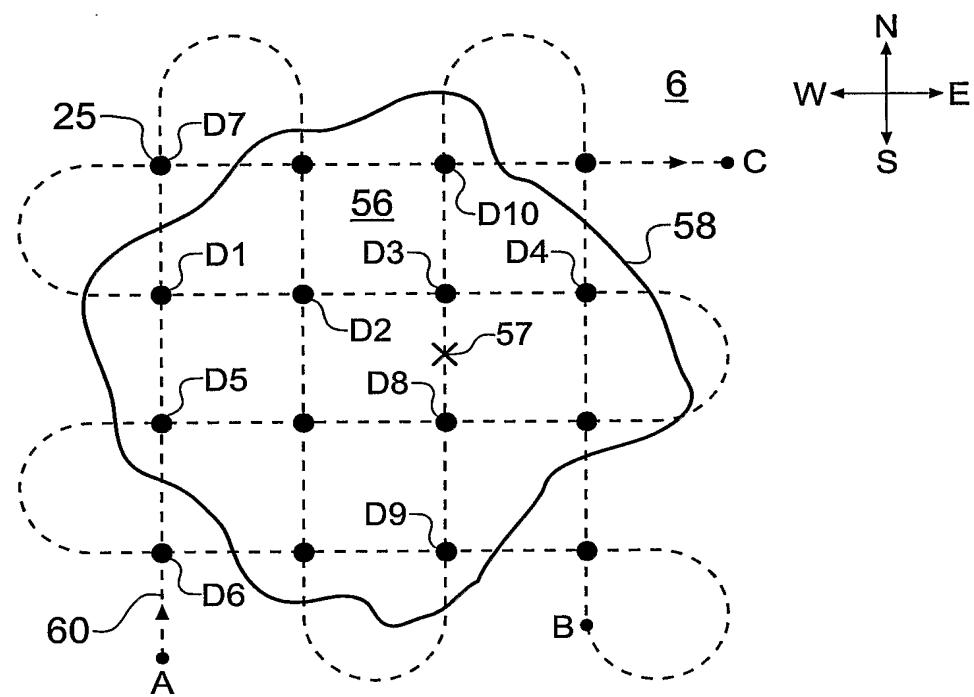


Fig. 2
PRIOR ART

3/17

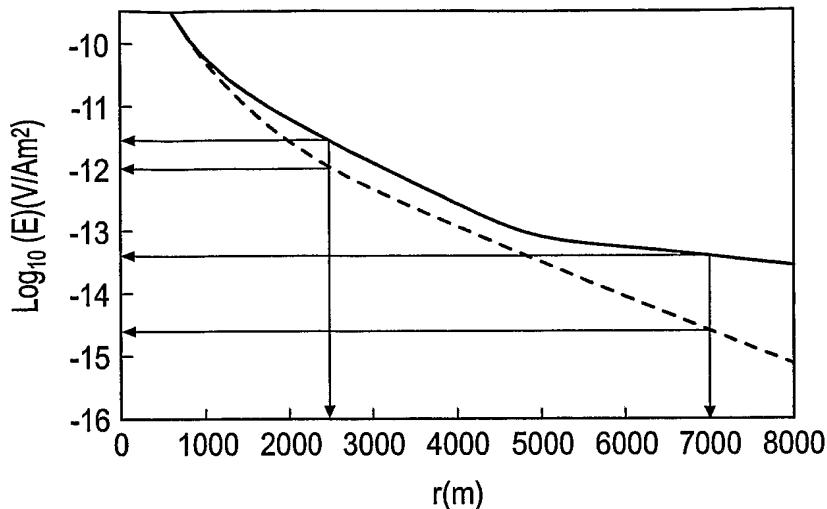


Fig. 3A
PRIOR ART

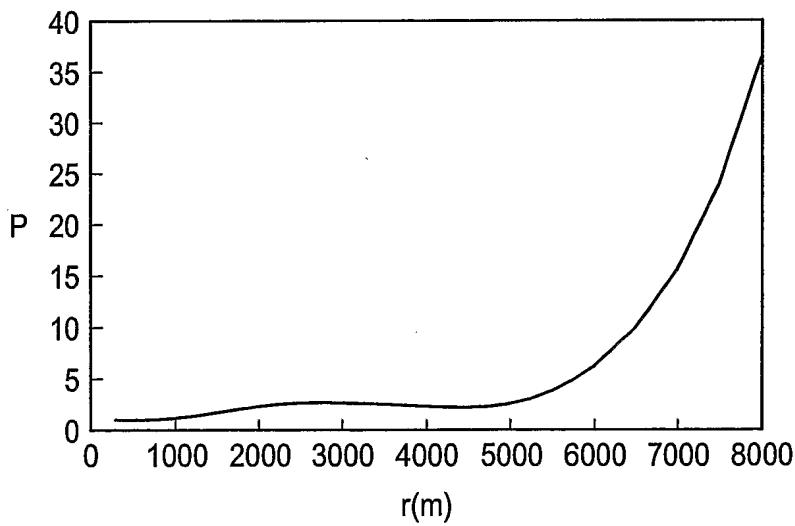


Fig. 3B
PRIOR ART

4/17

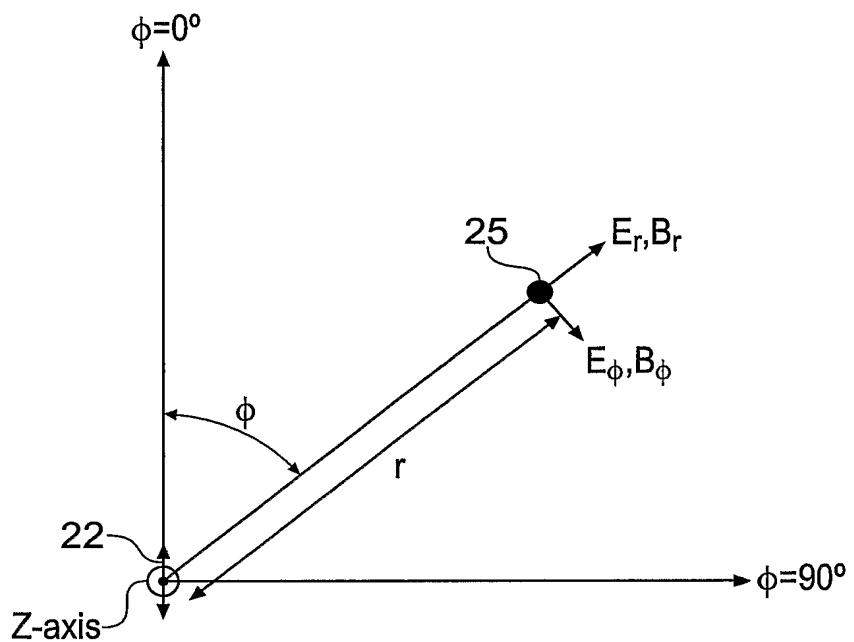


Fig. 4

5/17

$$\begin{aligned}
E_r = & \frac{P\rho_0 \cos \phi}{4\pi} \int_0^\infty \left[\left(\underbrace{-\beta_0 \frac{k J_0(kr) - \frac{J_1(kr)}{r}}{1 + R_L^{TM} e^{-2\beta_0 h}} + i \underbrace{\frac{\omega \mu_0 J_1(kr)}{r \beta_0 \rho_0 (1 - R_A^{TE} R_L^{TE} e^{-2\beta_0 h})}}_{TE} \right) e^{-\beta_0 |z-z'|} + \right. \right. \\
& \left(\underbrace{\beta_0 \frac{k J_0(kr) - \frac{J_1(kr)}{r}}{1 + R_L^{TM} e^{-2\beta_0 h}} R_L^{TM} + i \underbrace{\frac{\omega \mu_0 J_1(kr)}{r \beta_0 \rho_0 (1 - R_A^{TE} R_L^{TE} e^{-2\beta_0 h})} R_L^{TE}}_{TE} \right) e^{-\beta_0 (z+z')} + \\
& \left(\underbrace{-\beta_0 \frac{k J_0(kr) - \frac{J_1(kr)}{r}}{1 + R_L^{TM} e^{-2\beta_0 h}} + i \underbrace{\frac{\omega \mu_0 J_1(kr)}{r \beta_0 \rho_0 (1 - R_A^{TE} R_L^{TE} e^{-2\beta_0 h})} R_A^{TE}}_{TE} \right) e^{\beta_0 (z+z'-2h)} + \\
& \left. \left. \left(\underbrace{\beta_0 \frac{k J_0(kr) - \frac{J_1(kr)}{r}}{1 + R_L^{TM} e^{-2\beta_0 h}} R_L^{TM} + i \underbrace{\frac{\omega \mu_0 J_1(kr)}{r \beta_0 \rho_0 (1 - R_A^{TE} R_L^{TE} e^{-2\beta_0 h})} R_A^{TE} R_L^{TE}}_{TE} \right) e^{\beta_0 (|z-z'|-2h)} \right] dk \right)
\end{aligned}$$

Fig. 5A (EQ.1)

$$\begin{aligned}
E_\phi = & \frac{P\rho_0 \sin \phi}{4\pi} \int_0^\infty \left[\left(\underbrace{\frac{\beta_0 J_1(kr)}{r(1 + R_L^{TM} e^{-2\beta_0 h})} - i \underbrace{\frac{k J_0(kr) - \frac{J_1(kr)}{r}}{\beta_0 \rho_0 (1 - R_A^{TE} R_L^{TE} e^{-2\beta_0 h})}}_{TE} \right) e^{-\beta_0 |z-z'|} + \right. \right. \\
& \left(\underbrace{-\frac{\beta_0 J_1(kr)}{r(1 + R_L^{TM} e^{-2\beta_0 h})} R_L^{TM} - i \underbrace{\frac{k J_0(kr) - \frac{J_1(kr)}{r}}{\beta_0 (1 - R_A^{TE} R_L^{TE} e^{-2\beta_0 h})} R_L^{TE}}_{TE} \right) e^{-\beta_0 (z+z')} + \\
& \left(\underbrace{\frac{\beta_0 J_1(kr)}{r(1 + R_L^{TM} e^{-2\beta_0 h})} - i \underbrace{\frac{k J_0(kr) - \frac{J_1(kr)}{r}}{\beta_0 \rho_0 (1 - R_A^{TE} R_L^{TE} e^{-2\beta_0 h})} R_A^{TE}}_{TE} \right) e^{\beta_0 (z+z'-2h)} + \\
& \left. \left. \left(\underbrace{-\frac{\beta_0 J_1(kr)}{r(1 + R_L^{TM} e^{-2\beta_0 h})} R_L^{TM} - i \underbrace{\frac{k J_0(kr) - \frac{J_1(kr)}{r}}{\beta_0 \rho_0 (1 - R_A^{TE} R_L^{TE} e^{-2\beta_0 h})} R_A^{TE} R_L^{TE}}_{TE} \right) e^{\beta_0 (|z-z'|-2h)} \right] dk \right)
\end{aligned}$$

Fig. 5B (EQ.2)

$$\begin{aligned}
E_z = & \frac{P\rho_0 \cos \phi}{4\pi} \int_0^\infty \frac{k^2 J_1(kr)}{1 + R_L^{TM} e^{-2\beta_0 h}} \left[\mp e^{-\beta_0 |z-z'|} - R_L^{TM} e^{-\beta_0 (z+z')} - e^{\beta_0 (z+z'-2h)} \mp \right. \\
& \left. R_L^{TM} e^{\beta_0 (|z-z'|-2h)} \right] dk
\end{aligned}$$

Fig. 5C (EQ.3)

6/17

$$\begin{aligned}
 B_r = & \frac{\mu_0 P \sin \phi}{4\pi} \int_0^\infty \left[\pm \left(\underbrace{\frac{J_1(kr)}{r(1+R_L^{TM}e^{-2\beta_0 h})}}_{TM} + \underbrace{\frac{k J_0(kr) - \frac{J_1(kr)}{r}}{1-R_A^{TE}R_L^{TE}e^{-2\beta_0 h}}}_{TE} \right) e^{-\beta_0|z-z'|} + \right. \\
 & \left(\underbrace{\frac{J_1(kr)}{r(1+R_L^{TM}e^{-2\beta_0 h})} R_L^{TM}}_{TM} - \underbrace{\frac{k J_0(kr) - \frac{J_1(kr)}{r}}{1-R_A^{TE}R_L^{TE}e^{-2\beta_0 h}} R_L^{TE}}_{TE} \right) e^{-\beta_0(z+z')} + \\
 & \left(\underbrace{\frac{J_1(kr)}{r(1+R_L^{TM}e^{-2\beta_0 h})}}_{TM} + \underbrace{\frac{k J_0(kr) - \frac{J_1(kr)}{r}}{1-R_A^{TE}R_L^{TE}e^{-2\beta_0 h}} R_A^{TE}}_{TE} \right) e^{\beta_0(z+z'-2h)} \pm \\
 & \left. \left(\underbrace{\frac{J_1(kr)}{r(1+R_L^{TM}e^{-2\beta_0 h})} R_L^{TM}}_{TM} - \underbrace{\frac{k J_0(kr) - \frac{J_1(kr)}{r}}{1-R_A^{TE}R_L^{TE}e^{-2\beta_0 h}} R_A^{TE}R_L^{TE}}_{TE} \right) e^{\beta_0(|z-z'|-2h)} \right] dk
 \end{aligned}$$

Fig. 5D (EQ.4)

$$\begin{aligned}
 B_\phi = & \frac{\mu_0 P \cos \phi}{4\pi} \int_0^\infty \left[\pm \left(\underbrace{\frac{k J_0(kr) - \frac{J_1(kr)}{r}}{1+R_L^{TM}e^{-2\beta_0 h}}}_{TM} + \underbrace{\frac{J_1(kr)}{r(1-R_A^{TE}R_L^{TE}e^{-2\beta_0 h})}}_{TE} \right) e^{-\beta_0|z-z'|} + \right. \\
 & \left(\underbrace{\frac{k J_0(kr) - \frac{J_1(kr)}{r}}{1+R_L^{TM}e^{-2\beta_0 h}} R_L^{TM}}_{TM} - \underbrace{\frac{J_1(kr)}{r(1-R_A^{TE}R_L^{TE}e^{-2\beta_0 h})} R_L^{TE}}_{TE} \right) e^{-\beta_0(z+z')} + \\
 & \left(\underbrace{\frac{k J_0(kr) - \frac{J_1(kr)}{r}}{1+R_L^{TM}e^{-2\beta_0 h}}}_{TM} + \underbrace{\frac{J_1(kr)}{r(1-R_A^{TE}R_L^{TE}e^{-2\beta_0 h})} R_A^{TE}}_{TE} \right) e^{\beta_0(z+z'-2h)} \pm \\
 & \left. \left(\underbrace{\frac{k J_0(kr) - \frac{J_1(kr)}{r}}{1+R_L^{TM}e^{-2\beta_0 h}} R_L^{TM}}_{TM} - \underbrace{\frac{J_1(kr)}{r(1-R_A^{TE}R_L^{TE}e^{-2\beta_0 h})} R_A^{TE}R_L^{TE}}_{TE} \right) e^{\beta_0(|z-z'|-2h)} \right] dk
 \end{aligned}$$

Fig. 5E (EQ.5)

$$\begin{aligned}
 B_z = & \frac{\mu_0 P \sin \phi}{4\pi} \int_0^\infty \frac{k^2 J_1(kr)}{\beta_0(1-R_A^{TE}R_L^{TE}e^{-2\beta_0 h})} \left[e^{-\beta_0|z-z'|} + R_L^{TE}e^{-\beta_0(z+z')} + R_A^{TE}e^{\beta_0(z+z'-2h)} + \right. \\
 & \left. R_A^{TE}R_L^{TE}e^{\beta_0(|z-z'|-2h)} \right] dk
 \end{aligned}$$

Fig. 5F (EQ.6)

7/17

$$\frac{\partial E_r}{\partial z} - i\omega B_\phi = -\frac{P\rho_0 \cos \phi}{4\pi} \int_0^\infty k^2 \frac{k J_0(kr) - \frac{J_1(kr)}{r}}{1 + R_L^{TM} e^{-2\beta_0 h}} \left[\pm e^{-\beta_0|z-z'|} + R_L^{TM} e^{-\beta_0(z+z')} + e^{\beta_0(z+z'-2h)} \pm R_L^{TM} e^{\beta_0(|z-z'|-2h)} \right] dk$$

Fig. 5G (EQ.7)

$$\frac{\partial E_\phi}{\partial z} + i\omega B_r = \frac{P\rho_0 \sin \phi}{4\pi r} \int_0^\infty \frac{k^2 J_1(kr)}{1 + R_L^{TM} e^{-2\beta_0 h}} \left[\pm e^{-\beta_0|z-z'|} + R_L^{TM} e^{-\beta_0(z+z')} + e^{\beta_0(z+z'-2h)} \pm R_L^{TM} e^{\beta_0(|z-z'|-2h)} \right] dk$$

Fig. 5H (EQ.8)

8/17

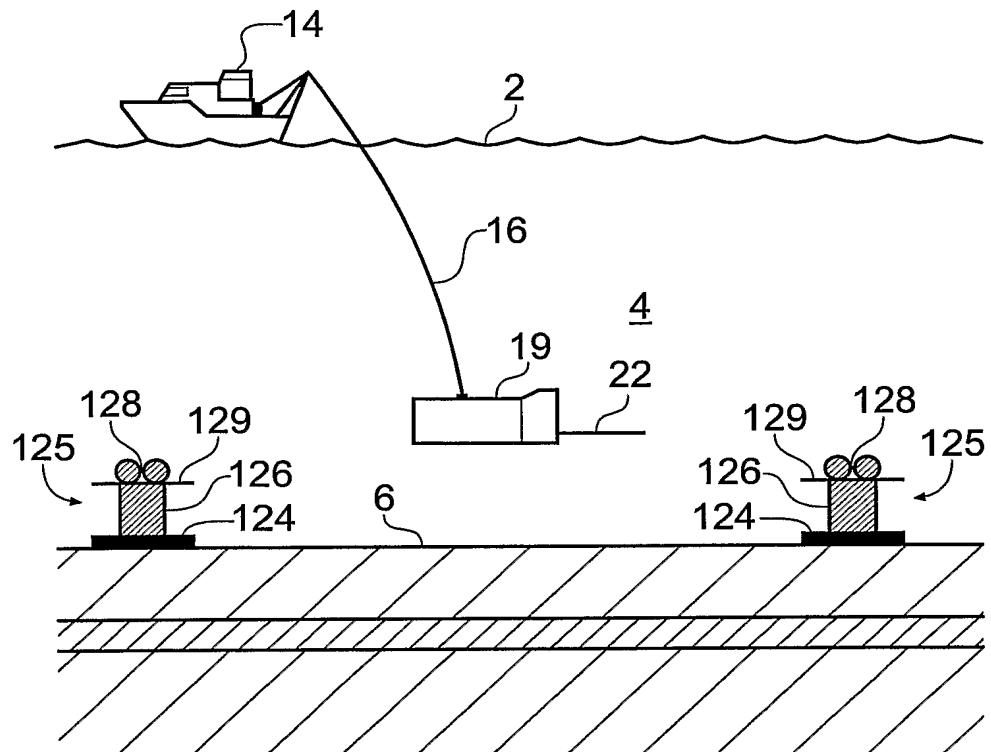


Fig. 6A

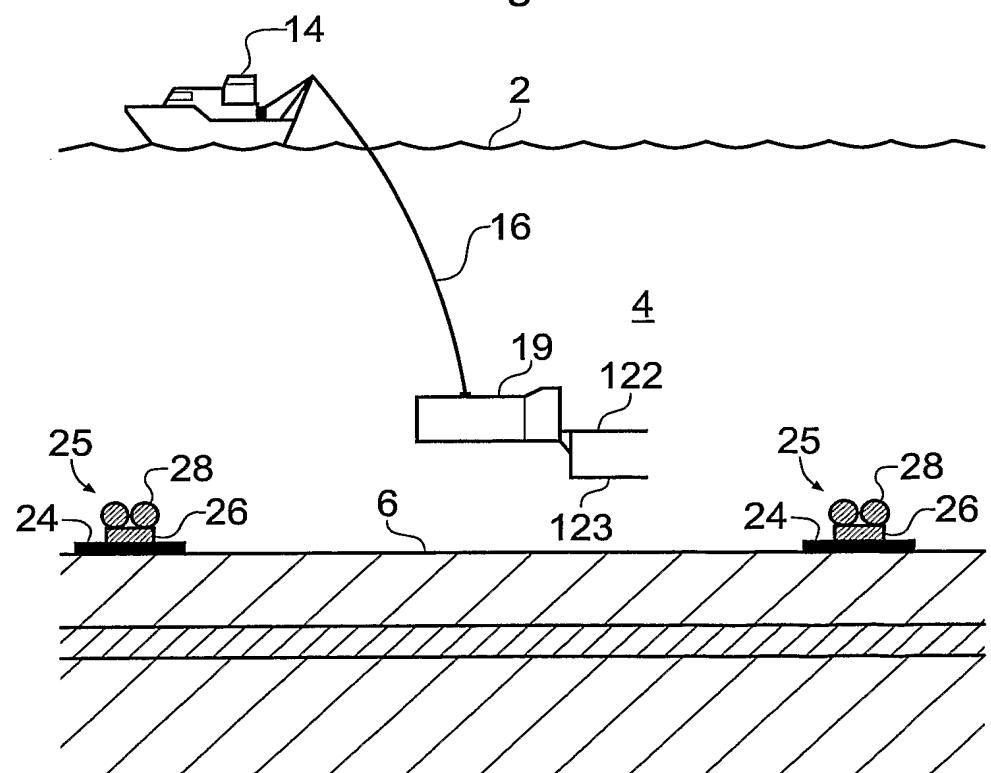


Fig. 6B

9/17

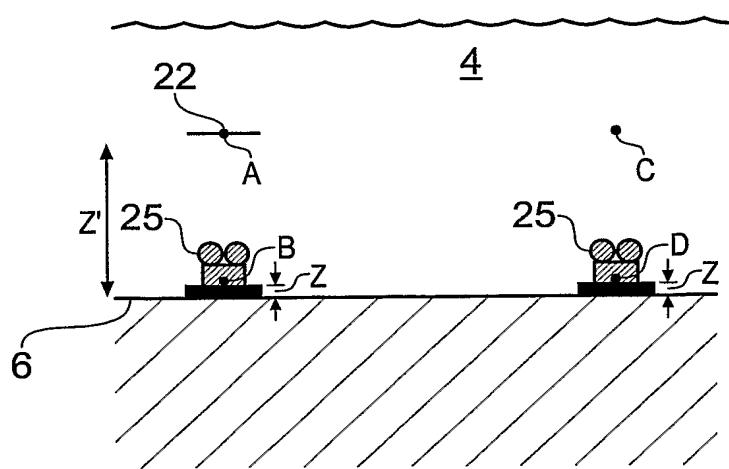


Fig. 7A

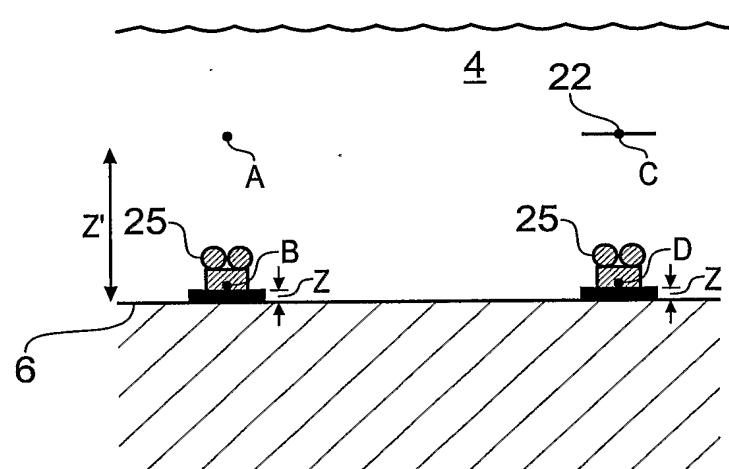


Fig. 7B

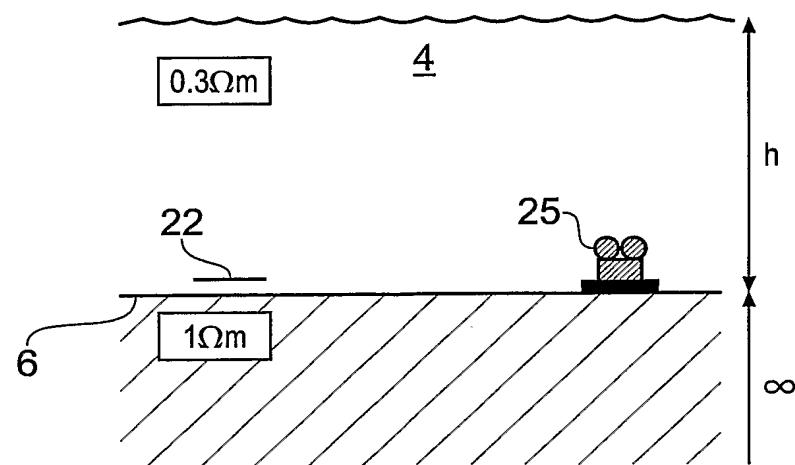


Fig. 8

10/17

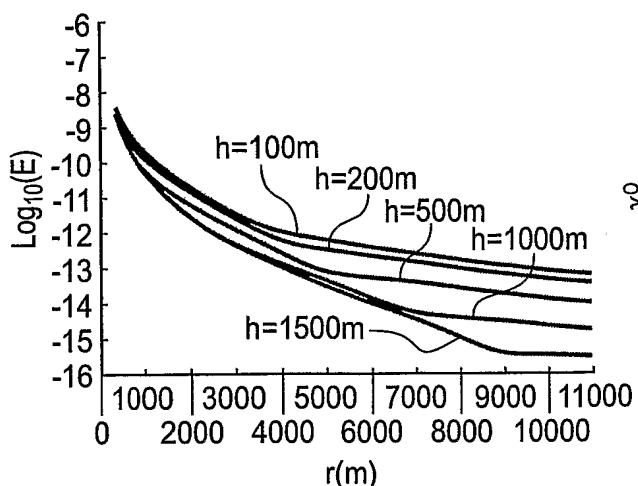


Fig. 9A

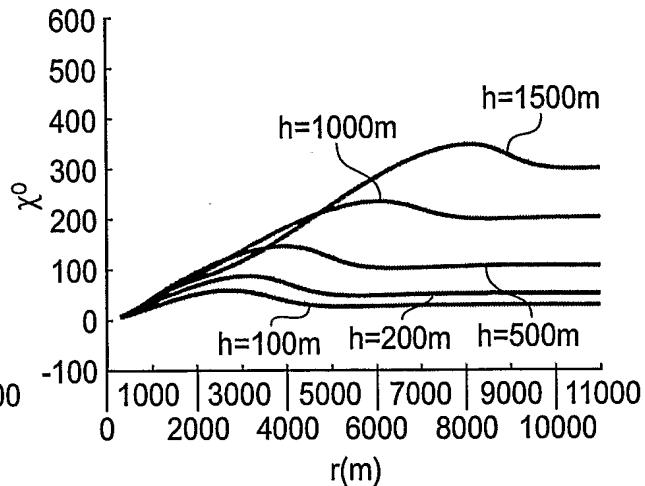


Fig. 9B

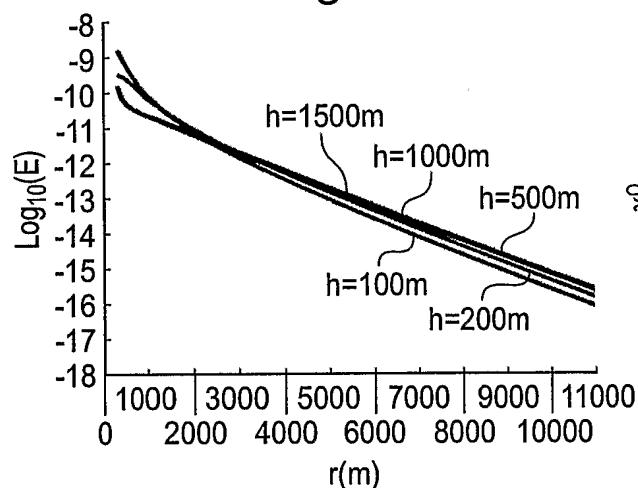


Fig. 10A

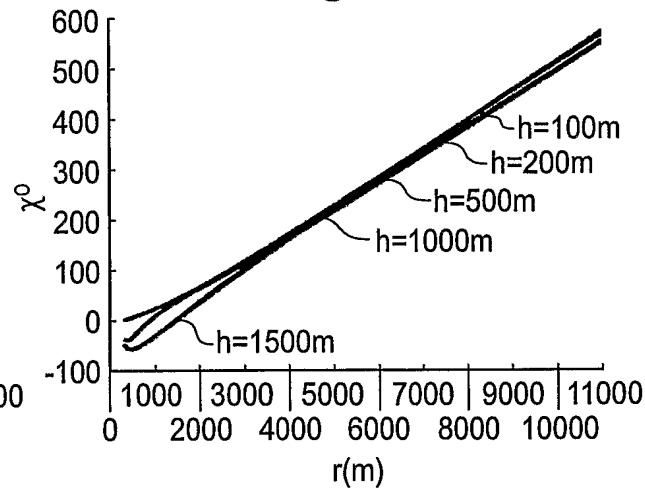


Fig. 10B

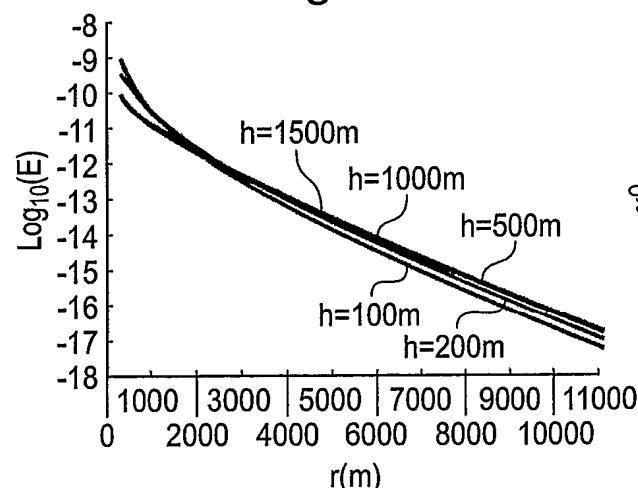


Fig. 10C

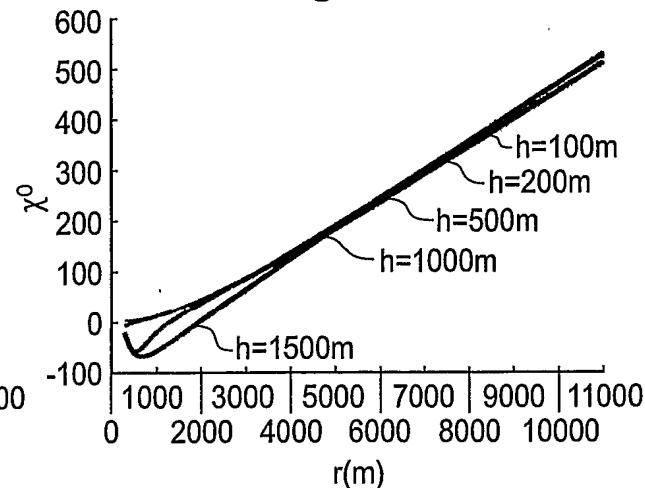


Fig. 10D

11/17

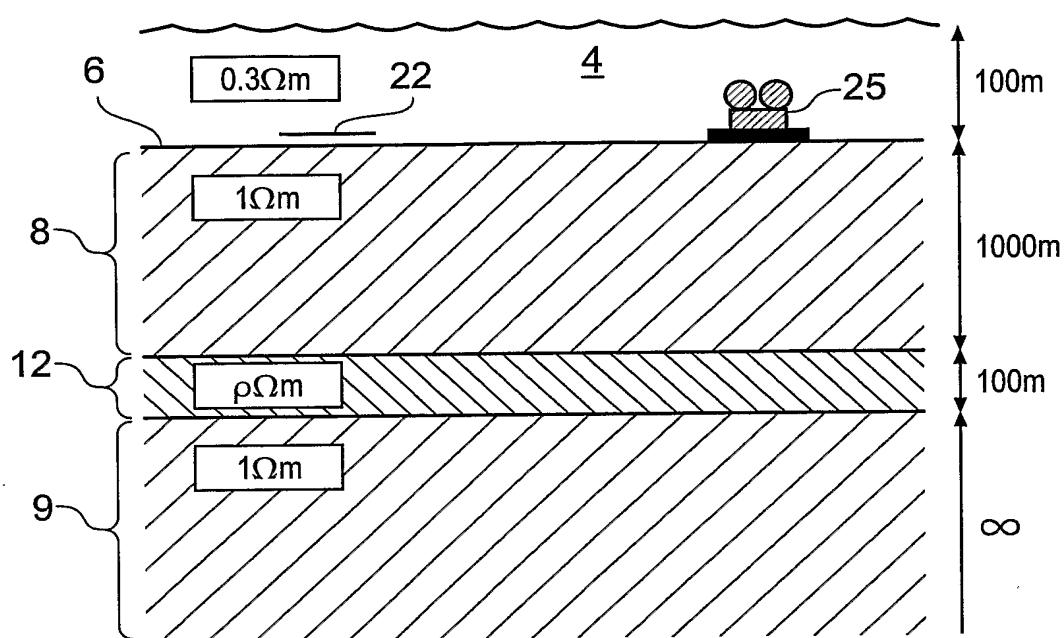


Fig. 11

12/17

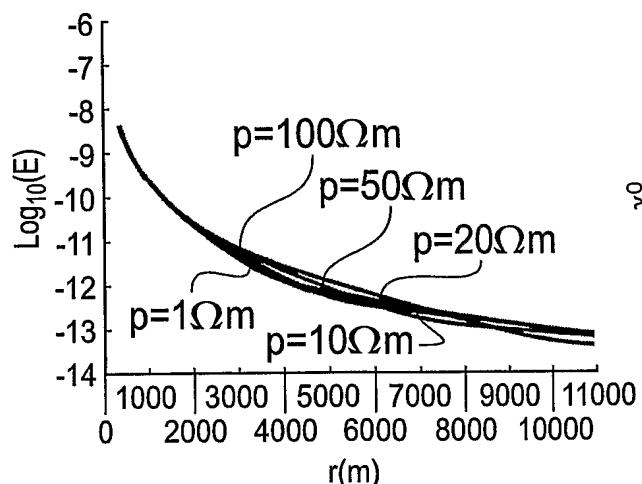


Fig. 12A

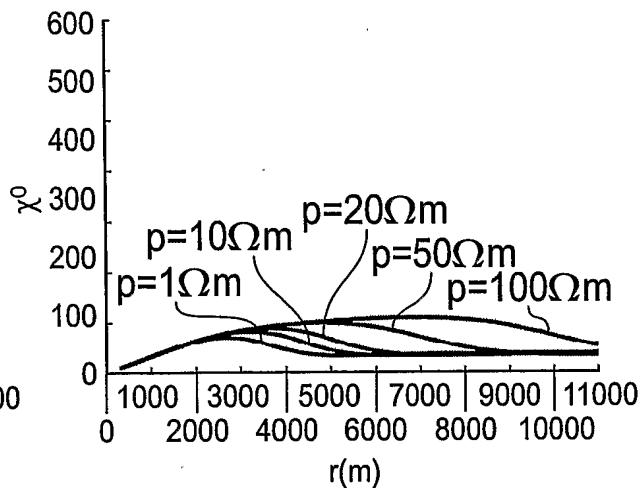


Fig. 12B

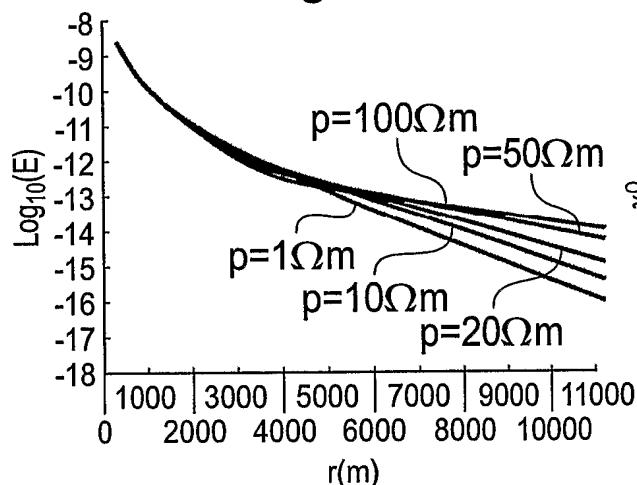


Fig. 13A

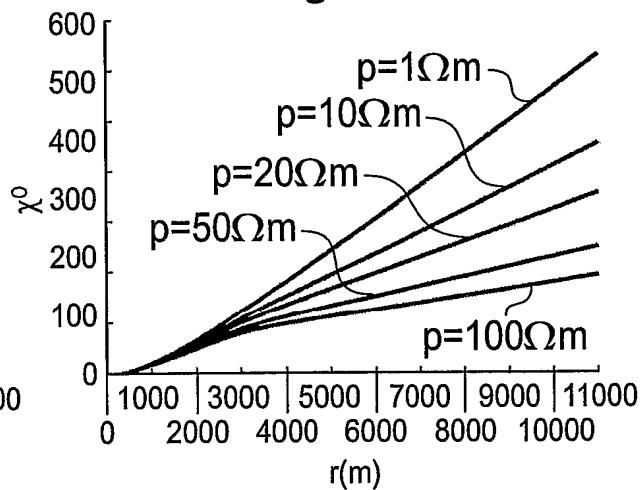


Fig. 13B

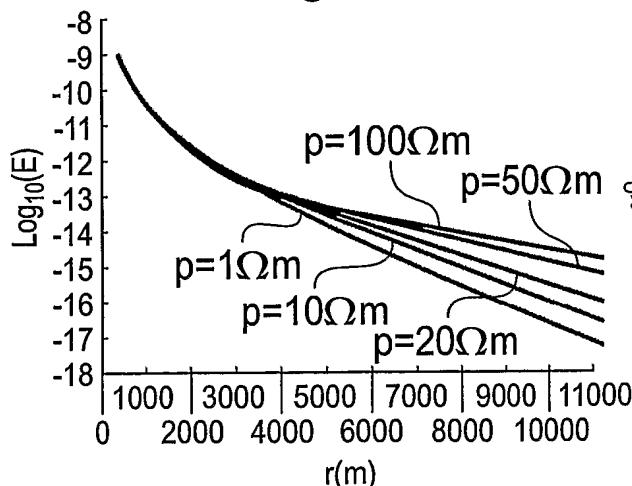


Fig. 13C

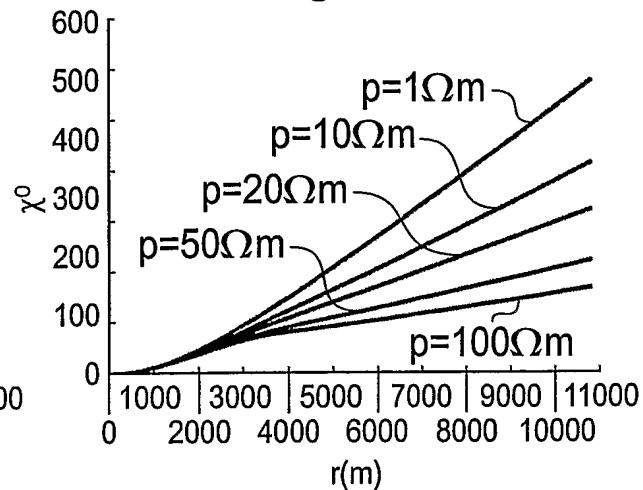


Fig. 13D

13/17

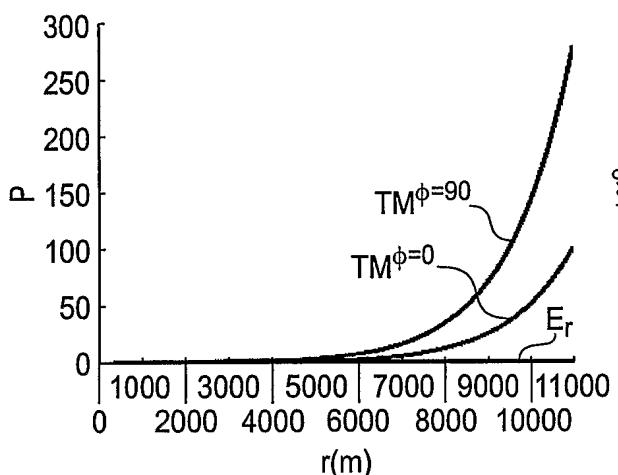


Fig. 14A

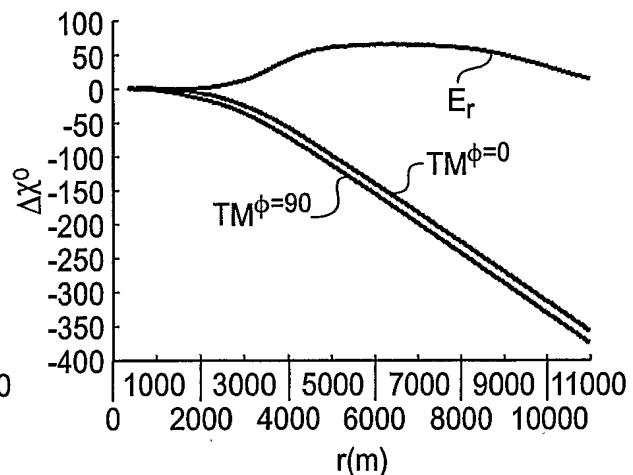


Fig. 14B

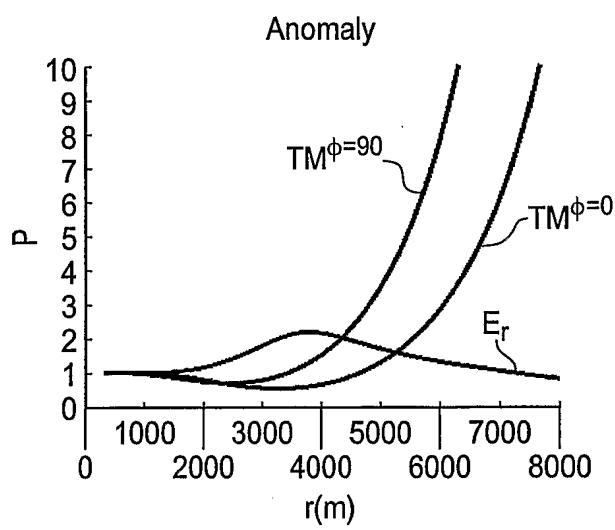


Fig. 14C

14/17

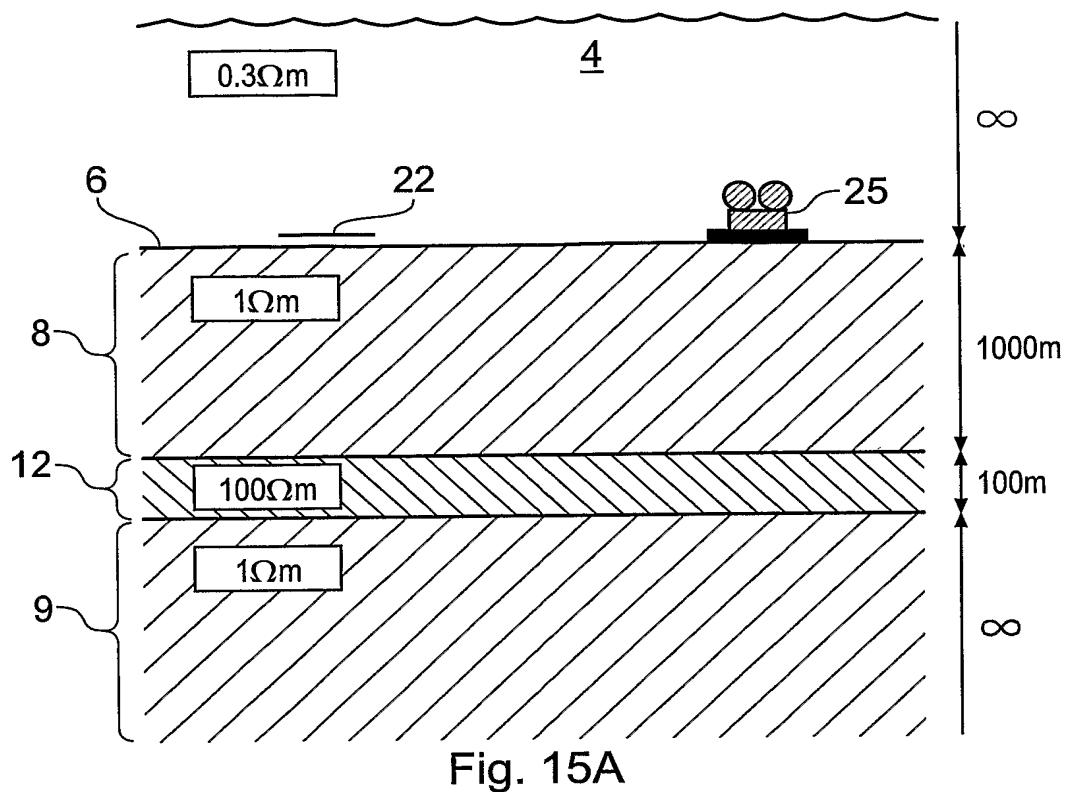


Fig. 15A

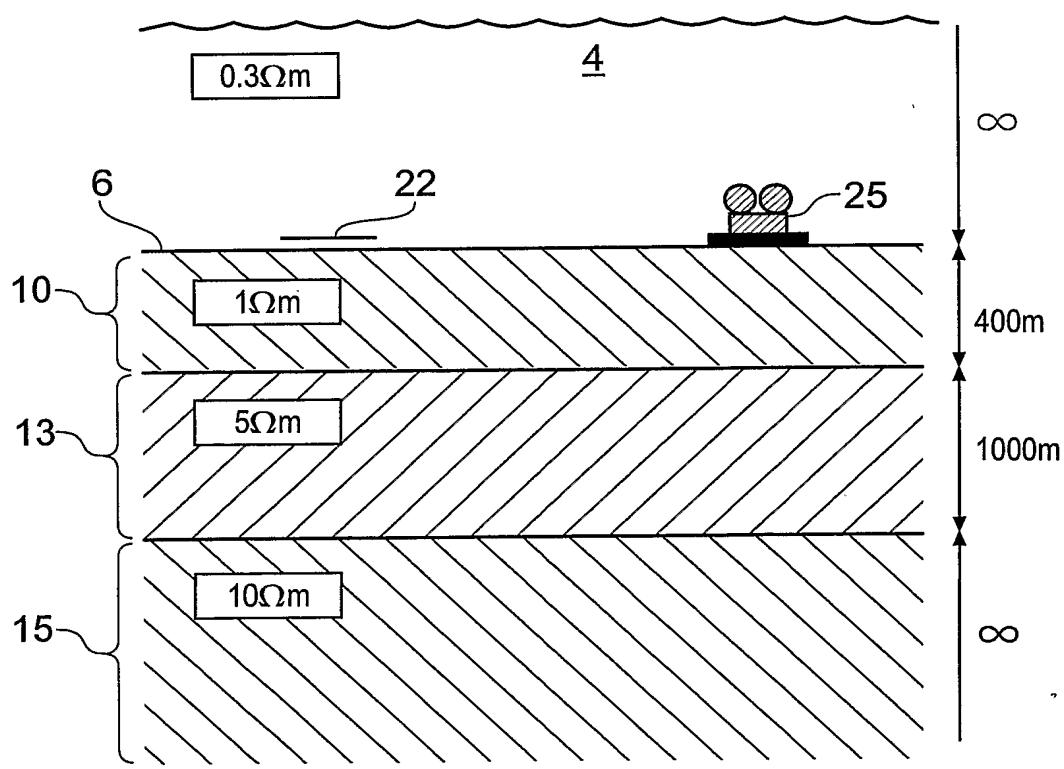


Fig. 15B

15/17

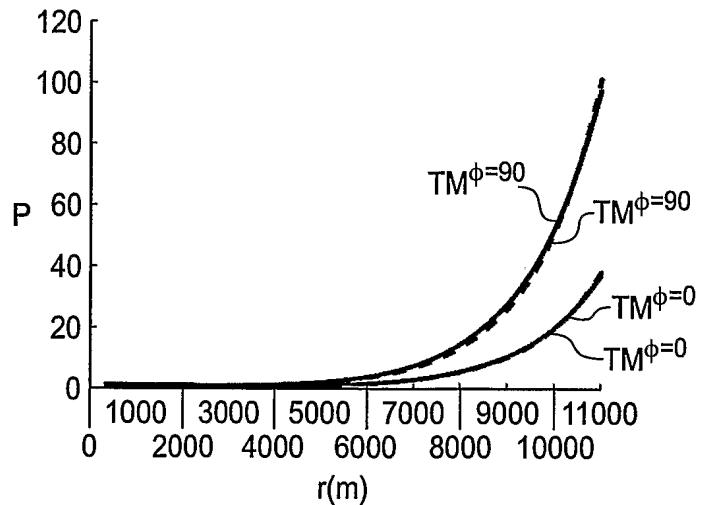


Fig. 16

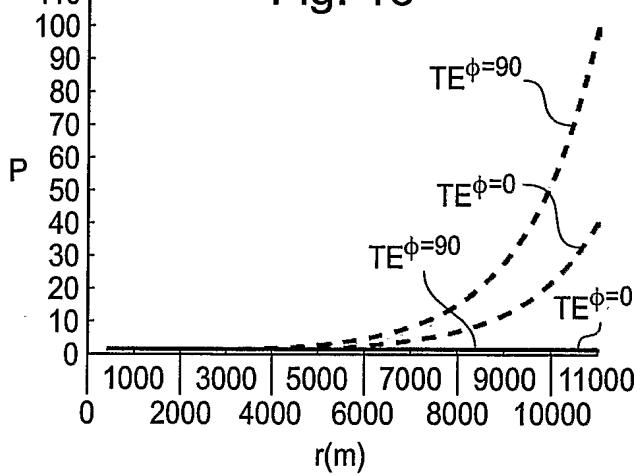


Fig. 18A

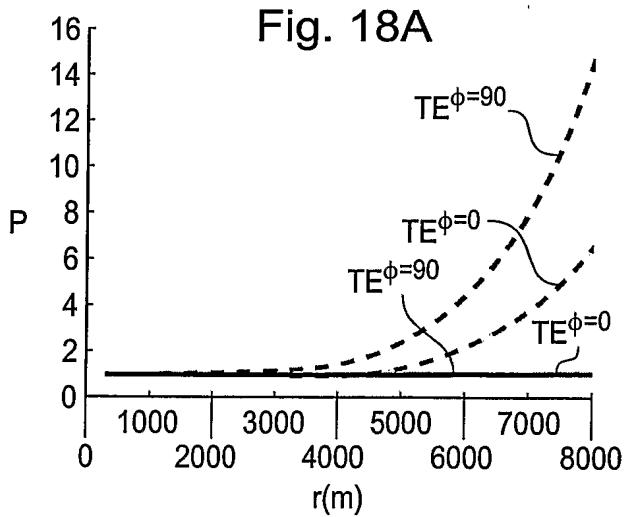


Fig. 18B

16/17

$$E_r + \frac{\rho_0}{\mu_0} \frac{\partial B_\phi}{\partial z} = \frac{P \rho_0 \cos \phi}{4\pi r} \int_0^\infty \frac{k^2 J_1(kr)}{\beta_0 (1 - R_A^{TE} R_L^{TE} e^{-2\beta_0 h})} \left[e^{-\beta_0 |z-z'|} + R_L^{TE} e^{-\beta_0 (z+z')} + R_A^{TE} e^{\beta_0 (z+z'-2h)} + R_A^{TE} R_L^{TE} e^{\beta_0 (|z-z'|-2h)} \right] dk$$

Fig. 17A (EQ.9)

$$E_\phi - \frac{\rho_0}{\mu_0} \frac{\partial B_r}{\partial z} = -\frac{P \rho_0 \sin \phi}{4\pi} \int_0^\infty \frac{k^2}{\beta_0} \frac{k J_0(kr) - \frac{J_1(kr)}{r}}{1 - R_A^{TE} R_L^{TE} e^{-2\beta_0 h}} \left[e^{-\beta_0 |z-z'|} + R_L^{TE} e^{-\beta_0 (z+z')} + R_A^{TE} e^{\beta_0 (z+z'-2h)} + R_A^{TE} R_L^{TE} e^{\beta_0 (|z-z'|-2h)} \right] dk$$

Fig. 17B (EQ.10)

17/17

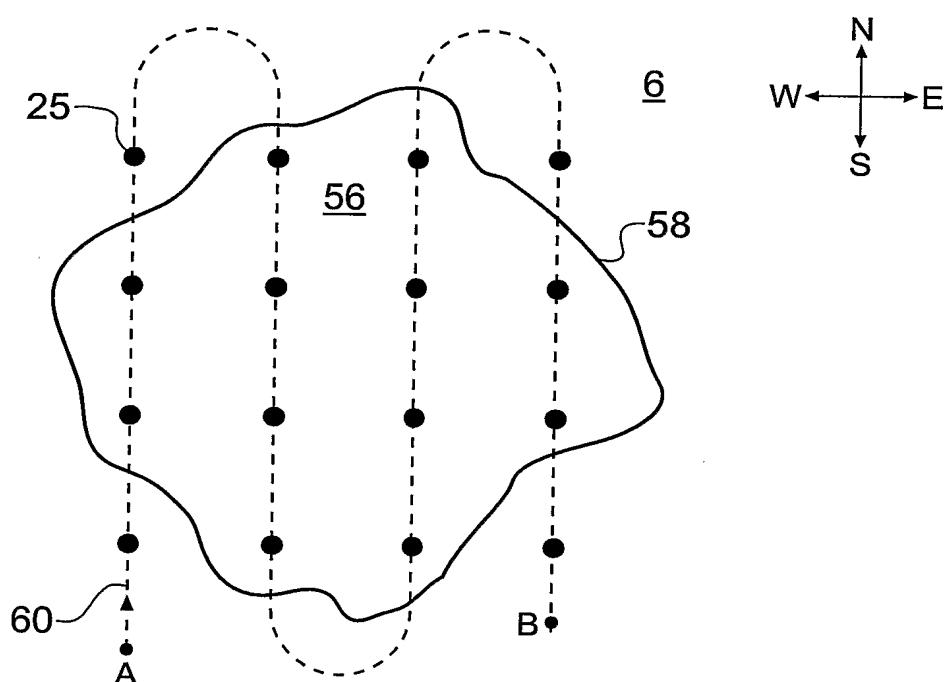


Fig. 19